UNIVERSITI PUTRA MALAYSIA

PHYTOCHEMICAL STUDIES OF MESUA CORNERI (LINN.) AND GARCINIA MANGOSTANA (LINN.) AND THEIR BIOLOGICAL ACTIVITIES

SHEIKH AHMAD IZADDIN SHEIKH MOHD GHAZALI.

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By

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Chairman : Associate Professor Gwendoline Ee Cheng Lian, PhD

Faculty : Science

Roots of *Garcinia mangostana L.* and the stem bark of *Mesua corneri L.* were chemically investigated. Detail phytochemical studies on the roots of *Garcinia mangostana L.* and the stem bark of *Mesua corneri L.* have resulted in the isolation of eleven compounds. The structures of these compounds were elucidated using spectroscopic experiments namely NMR, IR, UV and MS.

The root bark of *Garcinia mangostana L.* furnished six xanthones, α-mangostin, β-mangostin, γ-mangostin, garcinone-D, mangostanol and gartanin. Up to now, research has only been carried out on the fruit hull and the stem bark of this plant. There have been no studies yet on the root bark of *Garcinia mangostana L.* Meanwhile, investigations on stem bark of *Mesua corneri L* gave three triterpenoid, stigmasterol,

fridelin, friedelan-1,3-dione and two xanthones, rubraxanthone and Inophyllin B. So far, there has been no reports at all on this plant.

The crude hexane and chloroform extracts of *Mesua corneri L.* stem bark were active against HL-60 cell line with IC_{50} values of less than 30 µg/ml. The crude hexane and chloroform extracts of *Garcinia mangostana L.* root bark were found to be active against CEM-SS cells line with IC_{50} values of less than 30 µg/ml. Meanwhile, the γ-mangostin gave a significant activity with an IC_{50} value of 4.7 µg/ml. This is a new activity for this plant.

The antimicrobial assay was carried out towards four pathogenic bacteria, Methicillin Resistant *Staphylococcus aures*, *Pseudomonas aeruginosa*, *Salmonella typhimurium* and *Bacillus subtilis*. Most of the crude extracts tested against these microbes gave only moderate or weak activities.

The larvicidal tests performed against the larvae of *Aedes aegypti*. The crude hexane and chloroform extracts of *Garcinia mangostana L.* showed a strong activity against the larvae with LC_{50} values of less than 100 µg/ml. The pure compounds α-mangostin and γ-mangostin gave good activities with LC_{50} value of 18.4 and 32.4 µg/ml respectively .The crude hexane and choloroform extracts of *Mesua corneri L.* showed a good activities against the larvae and gave LC_{50} values of less than 100 µg/ml. Rubraxanthone showed a strong activity against the larvae with a LC_{50} value of 18.4 µg/ml. These activities have not been reported before and this is a new finding.

The antifungal activity testing of the plant extracts were carried out against the fungi *Candida albican*, *Aspergillus ochraceaus*, *Sacchoromyces cerevisiae* and *Candida lypolytica*. No activity was observed for all the crude extracts.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

KAJIAN FITOKIMIA DAN AKTIVITI BIOLOGI DARIPADA *MESUA CONERI* (LINN.) DAN *GARCINIA MANGOSTANA* (LINN.)

Oleh

SHEIKH AHMAD IZADDIN

Januari 2006

Pengerusi : Profesor Madya Gwendoline Ee Cheng Lian, PhD

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Akar dari pokok *Garcinia mangostana* dan kulit batang dari pokok *Mesua corneri L.* telah dikaji secara kimia. Kajian fitokimia terperinci ke atas bahagian akar *Garcinia mangostana* dan bahagian kulit batang pada tumbuhan *Mesua corneri L* telah menghasilkan sebelas sebatian. Struktur sebatian-sebatian ini ditentukan dengan mengunakan eksperimen spekstroskopi seperti NMR, IR, UV dan MS.

Akar dari *Garcinia mangostana L.* telah menghasilkan enam xanthone iaitu, α-mangostin, β-mangostin, γ-mangostin, garcinone-D, mangostanol dan gartanin. Sehingga sekarang, kebanyakkan penyelidik hanya tertumpu kepada bahagian kulit buah dan kulit batang pada tumbuhan ini dan tiada kajian mengenai bahagian akar pada tumbuhan ini. Manakala, kajian terperinci terhadap kulit batang pokok. Mesua *corneri L.*telah menghasilkan tiga triterpenoid, stigmasterol, fridelin, friedelan-1,3-dione dan dua

xanthone, rubraxanthone dan inophyllin B.Tiada lagi laporan mengenai pokok ini diterbitkan.

Ekstrak mentah heksana dan kloroform *Garcinia moangostana L.* dianggap sebagai aktif ke atas sel HL-60 dengan nilai IC_{50} kurang daripada 30 μg/ml. Ekstrak mentah heksana dan kloroform *Meusa corneri L.* juga dianggap aktif ke atas sel CEM-SS dengan nilai IC_{50} kurang daripada 30 μg/ml. Sebatian tulen iaitu γ-mangostin telah menunjukkan keaktifan yang baik pada dengan IC_{50} adalah 4.7 μg/ml. Ini adalah penemuan bagi sebatian tulen ini.

Ujian anti-mikrobial dijalankan dengan menggunakan bakteria-bakteria jenis Methicillin Resistant *Staphylococcus aures*, *Pseudomonas aeruginosa*, *Salmonella typhimurium* dan *Bacillus subtilis*. Kebanyakan ekstrak yang diuji menunjukkan keaktifan yang sederhana atau rendah terhadap bakteria-bakteria.

Ujian larva telah dijalankan dengan menggunakan larva jenis *Aedes aegypti*. Kesemua ekstrak mentah *Garcinia mangostana* mempunyai aktiviti yang kuat terhadap terhadap larva dengan nilai LC_{50} kurang 100 μg/ml.Sebatian tulen iaitu α-mangostin dan γ-mangostin memberkan aktiviti yang kuat dengan LC_{50} adalah 18.4μg/ml dan 32.4 μg/ml. Ekstrak mentah *Mesua coneri* menunjukkan aktiviti yang baik terhadap larva dengan memberikan nilai LC_{50} kurang daripada 100 μg/ml. Rubraxanthone menunjukkan aktiviti yang kuat terhadap larva dengan nilai LC_{50} 18.4 μg/ml. Aktiviti ini belum pernah lagi dilaporkan sebelumi ini dan ini adalah penemuan baru.

Aktiviti anti-fungal ekstrak tumbuhan telah dijalankan ke atas *Candida albican*, *Aspergillus ochraceaus*, *Sacchoromyces cerevisiae* dan *Candida lypolytica.* Tiada aktiviti diperhatikan ke atas semua ektrak mentah.

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I certify that an Examination Committee met on 23 Januari 2006 to conduct the final examination of Sheikh Ahmad Izaddin bin Sheikh Mohd. Ghazali on his Master of Science thesis entitled "Phytochemical Studies of *Mesua corneri* (Linn.) and *Garcinia mangostana* (Linn.) and Their Biological Activities" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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This thesis submitted to the Senate of Universiti Putra Malaysia has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee are as follows:

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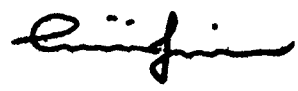

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Date: 13 APR 2006

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

SHEIKH AHMAD IZADDIN

Date: 13 MAR 2006

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α	alpha
β	beta
δ	chemical shift in ppm
γ	gamma
μg	micro gram
br s	broad singlet
br t	broad triplet
^{13}C	carbon-13
$CHCl_3$	chloroform
$CDCl_3$	deuterated chloroform
COSY	Correlated Spectroscopy
d	doublet
dd	doublet of doublet
DEPT	Distortionless Enhancement by Polarization Transfer
DMSO	dimethylsulfoxide
dt	doublet of triplet
EA	ethyl acetate
EIMS	Electron ionisation mass spectrometry
g	gram
GC	Gas Chromatography
GC-MS	Gas Chromatography- Mass Spectrometry

^1H	proton
HETCOR	Heteronuclear Chemical Shift-correlation
HMBC	Heteronuclear Multiple Bond Connectivity by 2D Multiple Quantum
HPLC	High Performance Liquid Chromatography
Hz	Hertz
IC	Inhibition Concentration
IR	Infra Red
J	coupling constant in Hz
l	litre
LC	Lethal Concentration
LD	Lethal Dose
m	multiplet
ml	mililitre
Me_2CO	acetone
MeOH	methanol
m.p.	melting point
MS	Mass Spectrum/Spectra/Spectrometry
NMR	Nuclear Magnetic Resonance
ppm	part per million
s	singlet
t	triplet
TLC	Thin Layer Chromatography
UV	Ultra Violet

WHO	World Health Organization